Serial No. 10/658,804
60426-843 PUS1

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Ahmed
Serial No.:	10/658,804
Filed:	September 9, 2003
Group Art Unit:	2838
Examiner:	Laxton, Gary L.
Title:	TRI-LEVEL INVERTER

Mail Stop – Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPEAL BRIEF

Dear Sir:

Appellant submits this Appeal Brief pursuant to the Notice of Appeal filed November 30, 2007. The Commissioner is authorized to charge Deposit Account No. 50-1482 in the name of Carlson, Gaskey & Olds, and $510.00 for the appeal brief fee. Any additional fees or credits may be charged or applied to Deposit Account No. 50-1482 in the name of Carlson, Gaskey & Olds.

REAL PARTY IN INTEREST

The real party in interest is Continental Automotive Systems US, Inc., assignee of the present invention.

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RELATED APPEALS AND INTERFERENCES

There are no prior or pending appeals, interferences or judicial proceedings related to this appeal, or which may directly affect or may be directly affected by, or have a bearing on, the Board's decision in this appeal.

STATUS OF CLAIMS

Claims 1-3, 11-14 and 20-25 are pending, claims 4-10 and 15-19 have been cancelled. Claims 1-3, 11-14, and 20-25 stand rejected and are appealed.

STATUS OF AMENDMENTS

All amendments have been entered.

SUMMARY OF CLAIMED SUBJECT MATTER

Power modules are typically self-contained units that transform power from on or more power sources to one or more loads such as for example an electric motor. In many instances, the power module is custom built and designed to the specific needs of a desired application. Such custom design increases cost and time to produce and build.

The disclosed and claimed power module includes architecture for a power module tri-level inverter that is modular and adaptable to many different requirements and applications. The disclosed and claimed power module 10 includes a lead frame housing 12, and integrated cold plate 14 attached to the housing 12 by bushings 12, a DC bus 16, a DC bus 18 and a plurality of power semi-conducting devices 20 that are electrically coupled to the DC bus 18 and the AC bus 18. (Page 4, lines 18-24, Figures 1, 2A and 2B).

The integrated cold plate 14 includes a metal base plate 39, a direct copper bonded substrate 40 which is attached to the metal base plate by a solder layer 41. A cooling header 42 including a number of cooling structures such as fins 42a, one or more cooling channels 42B, a fluid inlet 42c and a fluid outlet 42d for providing fluid connection to and from the fluid channels 42b. The substrate 40inlcudes a first copper layer 40a, a ceramic layer 40b and as econ

PAGE 2/13 * RCVD AT 1/30/2008 12:30:16 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-5/8 * DNIS:2738300 * CSID:12489888363 * DURATION (mm-ss):02-44

doper layer 40c. The second copper layer 40c is etched to form electrically isolated patterns or structures for mounting of circuit components. (page 5, lines 15-25, Figure 3).

A tri-level inverter 70 is disposed within the power module 10. One of each pair of six terminals 28a-28b, 30a-30b, and 32a-32b is coupled to a neutral line in the housing 12 to provide a reference to a respective phase 64a, 64b, and 64c. The other of the terminals of each pair 28a-28b, 30a-30b, and 32a-32b is coupled to provide the first, second and third voltages V1, V2, and V3. (Page 10, lines 9-28, Figures 6-10).

Claim 1

Claim 1 recites a power module 10 including a module housing 15 and a cold plate 14 integrated into the module housing 15. The cold plate 14 including a direct copper bonded substrate 40 attached to a base plate by a solder layer 41. (Page 5, lines 15-25, Figure 3). Claim 1 further requires a set of DC terminals 24,26 accessible from an exterior of the module housing 15 and at least three pairs of AC terminals 28a-28b, 30a-30b, and 32a-32b that are accessible from the exterior of the module housing 15 and an inverter circuit 70 contained within the module housing 15 that is configurable to selectively switch between at least three output states and electrically coupled between the set of DC terminals 24,26 and the at least one of the pairs of AC terminals 28a-28b, 30a-30b, and 32a-32b . (Page 10, lines 9-28, Figures 6-10)

Claim 11

Claim 11 recites a power system that includes a DC power supply and a power module 10. The power module 10 including a module housing 15 and a cold plate 14 integrated into the module housing 15. The cold plate 14 including a direct copper bonded substrate 40 attached to a base plate by a solder layer 41. (Page 5, lines 15-25, Figure 3). Claim 11 further requires a pair of input terminals 24, 26 accessible from an exterior of the module housing 15, a DC bus 16, three pairs of output terminals 28a-28b, 30a-30b, and 32a-32b that are accessible from the exterior of the module housing 15 and an AC bus 18 that is electrically coupled to at least one of the three pairs of output terminals. An inverter circuit 70 is contained within the module housing

15 that is configurable to selectively switch between at least three output states and electrically coupled between the set of DC terminals 24,26 and the at least one of the pairs of AC terminals 28a-28b, 30a-30b, and 32a-32b . (Page 10, lines 9-28, Figures 6-10)

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

(1) Is the rejection of Claims 1-3, 11-14, and 20-25 under 35 U.S.C. § 103(a) as being obvious over U.S. Patent Application Publication No. 2002/0034088 to Parkhill et al. ("Parkhill") in view of the U.S. Patent No. 6,903,931 to McCordic et al. ("McCordic et al.") improper?

(2) Is the rejection of Claims 1-3, 11-14, and 20-25 under 35 U.S.C. § 103(a) as being obvious over U.S. Patent No. 5,517,063 to Schantz, Jr. et al. ("Schantz Jr.") in view of the U.S. Patent No. 6,903,931 to McCordic et al. ("McCordic et al.") improper?

ARGUMENT

(1) The rejection of Claims 1-3, 11-14, and 20-25 as being obvious over Parkhill et al. in view of McCordic et al.

Claims 1 and 11

Claims 1 and 11 require a housing including an integrated cold plate, wherein the old plate includes a direct copper bonded substrate attached to a base plate by a solder layer.

The proposed combination is not proper as it does not disclose or suggest all the limitations of claim 1 and is not proper as the references teach away from the proposed combination.

The McCordic et al. patent discloses a cold plate consisting of a graphite core sandwiched between aluminum skins. The graphite core includes a cutout near the edges such that devices along the edges are not cooled as efficiently as those in the middle. The desired result is to reduce cooling near the edges, and increase cooling in the middle portion, such that the overall

temperature is uniform. The reason this works is because cooling fluid is only flowed into contact with an edge of the cold plate, and is not flowed across the entire bottom surface.

Accordingly, heat transfer at the edges is much more efficient than in the middle. The reduction of heat transfer at the edges results in less heat transfer to the outside parts, but is equaled by the closer proximity to the cooling flow at the edges. Unlike the Parkhill device, the McCordic cooling plate handicaps cooling.

In Parkhill et al. cooling flow is provided along the entire surface of the base plate to cool effectively across the entire plate (Parkhill Figures 5 and 6). McCordic et al. has as a main purpose to provide less thermally conductive regions near the edges than is provided in central regions so that all devices are cooled to a substantially uniform temperature (McCordic et al. Col 2, lines 15-24).

Such a structure would not work with the Parkhill device as the entire bottom surface is in contact with the cooling flow. Therefore, the addition of the aluminum skins and the graphite layer would only add additional layers through which heat must be transferred. In other words, the sandwiched cold plate disclosed in McCordic is intended for edge cooled applications where cooling fluid flow is disposed only along the edge. Accordingly the inner graphite layer acts as a conduit for heat from a center portion out to the edges that are in contact with the cooling fluid flow.

If fluid flow is simply being flowed across an entire surface, the inclusion of additional intermediate layers, such as the two aluminum skins as utilized by the McCordic device, simply reduces the efficiency heat transfer from the heat source to the cooling fluid. For at least this reason the proposed combination is not proper as it would not work, provides no benefit and the disclosures themselves along with common knowledge actually teaches away from adding additional layers for improving heat transfer.

Dependent Claims

Additionally, the dependent claims include features that are not remotely disclosed or suggested by the proposed combination. Claims 20 and 23 require that the direct copper bonded

substrate include a first copper layer, a ceramic layer and as second cooper layer fused together. The proposed combination does not disclose or suggest this specific structure that includes the ceramic layer.

Claims 21 and 23 require that the second cooper layer is etched to electrically isolate structures for the mounting of the circuit components. The cold plate disclosed in McCordic et al. does not suggest or disclose these features.

Additionally, claims 22 and 25 require that the base plate include a first side with the solder layer that is attached to a solder layer and a second side in thermal contact with the fluid channel for cooling circuit components. In the McCordic et al. device the cooling fluid flow is in contact with the edges of the graphite layer. Further, in Parkhill et al. the fluid flow is in contact with the base plate (61) that does not disclose or suggest the claimed structure. Accordingly, the dependent claims also include features that are not disclosed or suggested by the proposed combination.

(2) The rejection of Claims 1-3, 11-14, and 20-25 under 35 U.S.C. § 103(a) as being obvious Schantz, Jr. et al. in view McCordic et al.

<u>Claims 1 and 11</u>

The proposed combination of Schantz et al. with the edge cooled cold plate of McCordic et al. is not proper and the proposed combination would destroy the operation off the disclosed Shantz device. Further, the proposed combination is not proper as they teach away from the proposed combination.

The Schantz et al. device relies on cooling oil flow through the cooling plate 104 (Col 7, lines 45-55). The disclosed McCordic et al. device on the other hand provides an edge cooled plate where heat is transmitted from a center section toward edges adjacent a cooling fluid flow through a graphite layer sandwiched between aluminum skins. As discussed in detail above, flowing a cooling fluid over an entire surface teaches away from the structure disclosed in the McCordic et al. patent. For what reason would barriers to heat transfer in the form of additional

layers of materials (aluminum skins of McCordic et al.) be included for a device that flows cooling fluid across the entire back side of a circuit mounting area? There simply is none. In fact, the references teach away from such a combination. Accordingly, the proposed combination is improper.

Dependent Claims

The dependent claims include features that are not disclosed or suggested by the proposed combination. The Examiner has not indicated any portion of the proposed combinations where the features of the dependent claims are disclosed or suggested. As discussed above with regard to claims 20-25, the proposed combination does not disclose or suggest the claimed limitations and features.

CONCLUSION

For the reasons set forth above, the rejection of the claims is improper and should be reversed. Appellant earnestly requests such an action.

Respectfully Submitted,

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Dated: January 30, 2008

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CERTIFICATE OF FACSIMILE

I hereby certify that this Appeal Brief is being facsimile transmitted to the United States Patent and Trademark Office, 571-273-8300 on January 30, 2008.

Theresa M. Palmateer

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CLAIMS APPENDIX

1. A power module, comprising:

a module housing;

a cold plate integrated into the module housing, said cold plate including a direct copper bonded substrate attached to a base plate by a solder layer;

a set of DC terminals accessible from an exterior of the module housing;

at least three pairs of AC terminals accessible from the exterior of the module housing; and

an inverter circuit contained within the module housing, the inverter circuit configurable to selectively switch between at least three output states and electrically coupled between the set of DC terminals and at least one of the pairs of AC terminals.

2. The power module of claim 1, further comprising a set of control terminals accessible from the exterior of the module housing and electrically coupled to the inverter circuit.

3. The power module of claim 1, wherein the inverter circuit comprises at least three pairs of output nodes each electrically coupled to a respective one of the pairs of AC terminals.

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11. A power system, comprising:

a DC power supply;

a power module, comprising:

a housing including an integrated cold plate, wherein the cold plate includes a direct copper bonded substrate attached to a base plate by a solder layer;

a pair of input terminals accessible from an exterior of the housing, the input terminals electrically coupled to the DC power supply;

a DC bus electrically coupled to the pair of input terminals;

three pairs of output terminals accessible from the exterior of the housing;

an AC bus electrically coupled to at least one of the three pairs of output terminals; and

an inverter circuit configurable to selectively operate in one of at least three output states and electrically coupled between the DC bus and the AC bus; and

a controller to generate control signals to control the inverter circuit.

12. The power system of claim 11 wherein the controller is contained within the housing of the power module.

13. The power system of claim 11, further comprising:

a load, wherein each pair of output terminals is electrically coupled to the AC bus to supply a respective phase of three-phase AC power to the load.

14. The power system of claim 11, further comprising:

a number of loads, wherein each pair of output terminals is electrically coupled to the AC bus to supply AC power to a respective one of the loads.

20. The power module as recited in claim 1, wherein the direct copper bonded substrate includes a first copper layer, a ceramic layer and a second copper layer fused together.

21. The power module as recited in claim 20, wherein the second copper layer is etched to form electrically isolated structures for selectively mounting circuit components.

22. The power module as recited in claim 20 wherein the base plate includes a first side to which the solder layer is attached and a second side in thermal contact with a fluid channel for cooling circuit components mounted to the direct copper bonded substrate.

23. The power module as recited in claim 11, wherein the direct copper bonded substrate includes a first copper layer, a ceramic layer and a second copper layer fused together.

24. The power module as recited in claim 23, wherein the second copper layer is selectively segmented to define a plurality of electrically isolated structures for selectively mounting inverter circuit components.

25. The power module as recited in claim 23, wherein the base plate includes a first side to which the solder layer is attached and a second side in thermal contact with a fluid channel for cooling circuit components mounted to the direct copper bonded substrate.

Evidence Appendix

None.

Related Proceedings Appendix

None